Presentation Outline

• Understanding current and future oil production
  – Activity
  – Drilling economics
  – Forecasts

• Williston Basin oil transportation dynamics
  – Interstate oil movements
  – Intrastate oil movements

• North Dakota natural gas production
  – Flaring and gas capture
  – Natural Gas Liquids
North Dakota Drilling Activity

Spuds

Drilling Rigs

Spuds per Rig per Month

Bakken IP Rates

Initial Production (IP) Year – 2016 YTD Non-Confidential
Improving Well Performance

Average BKN/TF Well Performance in Williams, McKenzie, Dunn, & Mountrail Counties (Minimum 1 bopd)

JJ Kringstad - North Dakota Pipeline Authority
Average BKN/TF Well Performance in Williams, McKenzie, Dunn, & Mountrail Counties (Minimum 1 bopd)
A Quick Look at Bakken Drilling Economics…
North Dakota Oil Differential

Based on EIA Data
Key Economic Assumptions

• $6-$8 Million Well Costs
• $45/BBL & $2.00/MCF Wellhead Pricing
• 1/6 Royalty
• Zero Flaring
• Assumed 10-20% IRR to drill (calculated after production taxes and royalties)
• No Tax Incentives Included
• Production rate is 30-day average
• All Bakken/Three Forks wells drilled in 2008+
Peak Month Minimum 400 BOPD

Peak Month BOPD / Well Cost

<table>
<thead>
<tr>
<th>After Tax IRR</th>
<th>6 MM</th>
<th>7 MM</th>
<th>8 MM</th>
</tr>
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<tbody>
<tr>
<td>20%</td>
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<td>18%</td>
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<td>16%</td>
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<td>14%</td>
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<td>12%</td>
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<td>10%</td>
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<tr>
<td>8%</td>
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<td></td>
</tr>
<tr>
<td>6%</td>
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</tbody>
</table>

After Tax IRR: 20%

Breakeven Wellhead Price (AT IRR of 20%)

- 6 MM
- 7 MM
- 8 MM

$45 Wellhead

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Peak Month Minimum 500 BOPD

Peak Month BOPD / Well Cost

<table>
<thead>
<tr>
<th>Well Cost</th>
<th>After Tax IRR</th>
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<tbody>
<tr>
<td>6 MM</td>
<td>14%</td>
</tr>
<tr>
<td>7 MM</td>
<td>12%</td>
</tr>
<tr>
<td>8 MM</td>
<td>10%</td>
</tr>
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Breakeven Wellhead Price (AT IRR of 20%)

$45 Wellhead
Peak Month Minimum
600 BOPD

Peak Month BOPD / Well Cost

After Tax IRR

<table>
<thead>
<tr>
<th>Well Cost</th>
<th>600</th>
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</thead>
<tbody>
<tr>
<td>6 MM</td>
<td></td>
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<tr>
<td>7 MM</td>
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<tr>
<td>8 MM</td>
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</tbody>
</table>

Breakeven Wellhead Price (AT IRR of 20%)

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Peak Month Minimum 700 BOPD

Peak Month Well Production, BOPD

<table>
<thead>
<tr>
<th>Well Cost</th>
<th>6 MM</th>
<th>7 MM</th>
<th>8 MM</th>
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<tr>
<td>$0-$5</td>
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<td>$10-$15</td>
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<td>$30-$35</td>
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<td>$40-$45</td>
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<tr>
<td>$50-$55</td>
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</table>

Breakeven Wellhead Price (AT IRR of 20%)

- 6 MM
- 7 MM
- 8 MM

$45 Wellhead

After Tax IRR

- 35%
- 30%
- 25%
- 20%
- 15%
- 10%
- 5%
- 0%
Peak Month Minimum 800 BOPD

Peak Month BOPD / Well Cost

800

After Tax IRR

6 MM 7 MM 8 MM

$45 Wellhead

Breakeven Wellhead Price (AT IRR of 20%)

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Peak Month Minimum 900 BOPD

Peak Month BOPD / Well Cost

After Tax IRR

60%
50%
40%
30%
20%
10%
0%

$45 Wellhead

6 MM
7 MM
8 MM

Breakeven Wellhead Price (AT IRR of 20%)

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Peak Month Minimum 1,000 BOPD
Peak Month Minimum
1,200 BOPD
Peak Month Minimum
1,500 BOPD
Summary of $45 Wellhead Oil
Breakeven Summary

Peak Month Well Production, BOPD / Well Cost

Breakeven Wellhead Price (AT IRR of 20%)
Forecasting Future Activity…
US Crude Oil Storage (Excl. SPR)

Data Source: US Energy Information Administration
US Crude Oil Storage (Excl. SPR)

Data Source: US Energy Information Administration
North Dakota Forecast Activity Assumptions

Graph showing the forecast activity of new wells added per month from 2009 to 2035. The graph includes two cases:
- **ND New Wells Case 1**
- **ND New Wells Case 2**

The NDPA Forecast is indicated on the graph as a reference point.
Base Production Declines*

*Non-Confidential Bakken/Three Forks Production Only*
NDPA ND Oil Production Forecast

North Dakota Oil Production, BOPD

NDPA Forecast, Current Biennium
ND Oil Case 1
ND Oil Case 2
Next Biennium

NDPA ND Oil Production Forecast
North Dakota Oil Production Forecast

Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.
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Estimated Williston Basin Oil Transportation

- Pipeline Export: 55%
- Refined: 8%
- Truck to Canadian Pipelines: 35%
- Estimated Rail: 2%

October 2016
Estimated Williston Basin Oil Transportation

- Estimated Rail
- Estimated Pipeline Export
- Refined
- Truck to Canadian Pipelines
- Brent - WTI Spread (EIA)
Estimated ND Rail Export Volumes

Barrels Per Day

Rail Destinations Market Share (Oct. 2016)

Destination Market Share
- Canada
- PADD I (East Coast)
- PADD II (Midwest)
- PADD III (Gulf Coast)
- PADD IV (Rockies)
- PADD V (West Coast)

Data for Rail Destination Market Share Provided by the US Energy Information Administration

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Major Rail Lines and Refineries

EIA September 2016 Refiner Acquisition Cost

$44.21
$41.81
$40.22
$42.67
$45.11
Crude Oil Prices – Jan 4, 2016

Cushing $53.13

Brent $56.29
WTI + $3.16

Pricing Data: Bloomberg
**Williston Basin Truck Imports and Exports with Canada**

Data for truck imports/exports chart is provided by the US International Trade Commission.
Williston Basin Oil Production & Export Capacity, BOPD

Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.

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Evolution of Oil Gathering in ND
Evolution of Oil Gathering in ND Statewide Totals

- **Estimated Piped, BOPD**
  - 2012: 263,352
  - 2013: 410,629
  - 2015: 725,743
  - 2016: 718,177

- **Estimated Trucked, BOPD**
  - 2012: 485,966
  - 2013: 524,649
  - 2015: 441,644
  - 2016: 281,372
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Major Gas Pipeline and Processing Infrastructure
Solving the Flaring Challenge

GREEN – % of gas captured and sold
Blue – % flared from zero sales wells
Orange – % flared from wells with at least one mcf sold.

Simple Terms
Blue – Lack of pipelines
Orange – Challenges on existing infrastructure

Oct 2016 Data – Non-Confidential Wells

Statewide

- GREEN: 86%
- Blue: 2%
- Orange: 12%

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Solving the Flaring Challenge

Total ND Gas Flaring Percent (Color Indicates Reason)

- Flaring % From Wells Connected to Sales
- Flaring % From Wells Not Connected to Sales
- Total ND Gas Production

ND Gas Production, MMCFD
Capturing the 2% Faster Well Connections

- New Wells Selling Gas
- New Producing Wells
Solving the Flaring Challenge

- Suspended Capacity
- Existing Plant Capacity
- NDPA Case 1 Forecast
- NDPA Case 2 Forecast
- Historical Sold, MMCFD
- Historical Flared, MMCFD
- Targets Case 1 (Sold)
- Targets Case 1 (Flared)

- 91-93% Q4-20
- 85% Q4-16
- 88% Q4-18
- 77% Q2-16
- 74% Q4-14

Jan-05, Sep-05, May-06, Jan-07, Sep-07, May-08, Jan-09, Sep-09, May-10, Jan-11, Sep-11, May-12, Jan-13, Sep-13, May-14, Jan-15, Sep-15, May-16, Jan-17, Sep-17, May-18, Jan-19, Sep-19, May-20, Jan-21, Sep-21
Wellhead Gas Capture – Locations

Number of Remote Gas Capture Units Reporting

Number of Remote Gas Capture Units

<table>
<thead>
<tr>
<th>Month</th>
<th>Number</th>
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<tbody>
<tr>
<td>February 2014</td>
<td>2</td>
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<td>August 2014</td>
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<td>February 2015</td>
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<td>August 2015</td>
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<td>February 2016</td>
<td>28</td>
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<tr>
<td>August 2016</td>
<td>24</td>
</tr>
</tbody>
</table>
Wellhead Gas Capture – Intake Volume

Remote Gas Capture Intake Volumes

Total Intake, MMCFD

Wellhead & Plant Gas Capture

Field Unit

Field Processing Units

Traditional Gas Plants

% of Total Intake, MMCFD


2.7% 97.3%
NDPA ND Gas Production Forecast

- ND Gas Case 1 MMCFD
- ND Gas Case 2 MMCFD
Major NGL Pipeline and Processing Infrastructure

Kinder

Vantage (Ethane)

Alliance Tioga Lateral

Prairie Rose

Alliance (Dense Phase Gas)

ONEOK (Y-Grade)

Northern Border (High C2%)

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North Dakota Captured* NGL’s

*Non-flared NGL’s & Assumes 10 GPM
NGL Capacity Is Complicated…

Key Challenges

- Plant complexity varies
- Y-grade vs purity product
- Ethane capture equipment
- Scattered plant locations
- Market pricing
- Pipelines vary by type of product they can ship
- Uncertainty of Canadian and Wyoming volumes and quality
- Seasonal product demand
NGL Capacity Is Complicated…

Potential Solutions

- New, expanded, or repurposed pipeline systems
- Local consumption by new petrochemical industries
- Creative market solutions to manage plant NGL/BTUs
- Enhanced oil recovery
- Rail movements of excess products